Evaluation Of Lithium-Ion Polymer Battery Technology For Space

Principle Investigator: Professor Rudy Panholzer
Contact: Ron Phelps x2299, rphelps@nps.navy.mil

Introduction
NPSAT1 is a low-cost, technology demonstration satellite hosting a number of experiments. Commercial, off-the-shelf (COTS)-based technology will be implemented with custom designs to offer a low-cost command and data handling (C&DH) subsystem building on commercial, desktop PC architecture and standards-based specifications. In addition to an experimental C&DH subsystem, NPSAT1 will demonstrate the use of non-volatile ferroelectric RAM which is inherently radiation-tolerant and lithium-ion polymer batteries, state-of-the-art technology that will be employed offering high energy density (Watt-hr/kg) for space applications.

Experiments on-board NPSAT1 include two Naval Research Laboratory (NRL) payloads. The coherent electromagnetic radio tomography (CERTO) experiment and a Langmuir probe. The CERTO experiment is a radio beacon which, in concert with ground station receivers, is used to measure total-electron-content (TEC) in the ionosphere. The Langmuir probe will augment CERTO data by providing on-orbit measurements. The other experiments are of NPS origin. These include a novel design for a spacecraft computer board, a COTS visual imager (VISIM), and some micro-electromechanical systems (MEMS)-based rate sensors.

Description of Thesis Topic

The thesis student will perform a literature search for information on the characteristics of the lithium ion-polymer battery technology using the world wide web, technical journals, books and other sources which may be found. Knowledge acquired will be applied to the development of tests for lithium polymer batteries purchased by the Space Systems Academic Group. The student will design battery test plans and procedures for manipulating data generated by the battery test system. The student will also develop plotting routines using the GRI plotting language and Python scripts for automatically processing the data files.

The final objective of all the testing and the focus of the test performed is to determine under what circumstances the li-ion polymer battery will have

maximum cycle life. An additional objective is to determine an optimum charging regimen for on-orbit operation.

Proposed Outline

NPSat1 Introduction
Overview of Li-Ion Polymer Technology
Battery Test Plans
Data Reduction Manipulation and Storage Plan
Graphing and Data Management Scripts
Conclusions & Recommendations
Appendix of Test Plans and Scripts